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ERASMUS UNIVERSITY ROTTERDAM  
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# First-mover advantage in higher education

*An empirical review of entry order of universities in an emerging education  
discipline*

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## ABSTRACT

Goal of this research was to gain insights in the presence of first-mover advantages in the higher education sector. This paper examines if the early entry of universities in a new research field, on the basis of organizing an education program, leads to a long-term market share advantage of enregistered students. An empirical analysis of the Dutch higher education market indicates that the order of entry into an emerging (sub)discipline is inversely related to its relative market share. The analysis is carried out using a log linear model including the order of entry, time between entering universities, number of students at a university and the ranking of a university. All in all, this research finds that early entry of a university leads to a long-term advantage of market share in an emerging subdiscipline. These findings are supported by a number of robustness checks but should also be interpreted with caution due to several limitations. The potential existence of first-mover advantages in the higher education market has important managerial implications for universities. Moreover, this research demonstrates the presence of first-mover advantage in a different type of market than a regular market economy in which this phenomenon is usually studied.

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# 1. INTRODUCTION

## 1.1 The research question

First-mover advantage has been an interesting research topic for decades within strategy economics. The concept of benefiting from being first has been examined in different industries over different situations. The existing literature of first-mover advantage is mainly studied in traditional market economies, whereas industries with government intervention or different market structures did not get much interest in this research field. The higher education market, for instance, is a market in which public and private actors are often intertwined and which is more often associated with providing a public good of education rather than being a market economy. This thesis will study the potential existence of first-mover advantage in the higher education market which leads to the following research question:

*Do pioneering universities in an emerging (sub)discipline gain first-mover advantages compared to later entrants?*

The relevance within this research question lies mainly in determining if the concept of first-mover advantage is also applicable in a different market, such as higher education. The potential existence of pioneering advantage in this market could be relevant in several ways. First, this research could attribute to the current literature of first-mover advantage due to the analysis of a different market, which is not a traditional market economy as most industries where this phenomenon is examined. Second, the findings of this paper could include strategic implications for universities entering a new (sub)discipline. If the order of entry could lead to long-term advantage this could encourage universities to become the pioneer in an emerging research field and create a new education program first. This will be discussed in further detail after the research is conducted.

## 1.2 Thesis structure

After the introduction a literature review will give more detail in the existing research of first-mover advantage, as well as the market characteristics of the higher education industry. Based on the literature review the hypotheses are stated which will be the foundation of the research in this thesis. Next the data and methodology will be discussed which will be used in order to retrieve the final results. Finally, this thesis is finished with a conclusion and discussion.

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## 2. LITERATURE REVIEW

### 2.1 Existing literature on first-mover advantage

First-mover advantage (FMA) has been a topic of interest since the 1980s. Although the literature of FMA is mainly theory-focused, the concept of pioneer advantage finds its origin in empirical evidence proving that it pays to be the pioneer in a market. Early research in this area proved that pioneering firms gain extra revenue by extracting empirical evidence based on a few industries, such as pharmaceuticals (Bond and Lean, 1977; Gorecki, 1986) and cigarettes (Whitten, 1979). In 1988, FMA theory got real interest within strategy economics after the prominent scholars Lieberman & Montgomery (1988) published an article about drivers of pioneer advantage. They defined first-mover advantage as “the ability of pioneering firms to earn positive economic profits” (p.1). The concept of first-mover advantage finds empirical support within different industries but also has been disputed by several researchers. The existence of a pioneer advantage has experienced ongoing diffusion in the literature which still makes it a popular research topic today.

Within the early years of FMA theory, most of the conducted research confirmed that first entrants in a new developing market gained a lasting competitive advantage compared to later entrants. Research mainly focused on firm micro-level by looking at the resources and capabilities of firms. Robinson & Fornell (1985) claimed that firms with advantages in resources such as supply, product quality, and information can benefit from early entry. Moreover, Urban et al (1986), Lambkin (1988) and Carpenter & Nakamoto, (1989) all focused on the direct relationship between order of entry and firm performance.

Since Lieberman & Montgomery (1988) stressed that there could also be disadvantages of being the pioneer, pioneer advantage has been disputed more often. The focus on micro level aspects of FMA theory got exposed to a bigger set of factors, such as market dynamics, environmental variables and luck (Lieberman & Montgomery, 1988; Golder & Tellis, 1993; Schilling, 2002; Suarez & Lanzolla, 2007). This broader perspective of FMA complicates the demonstration of first-mover advantages and shows that researchers must take a lot more into account than just firm-level characteristics. These new insight in FMA could also explain why some industries support the existence of first-mover advantages and others don't. Research conducted by Golder & Tellis (1993) shows that, of their sample, almost half of the pioneering brands can't get feet on the ground in the emerging market they operate. Today, researchers focus on a more inclusive FMA theory that considers both, micro- and macro-level factors (Suarez & Lanzolla, 2007). Environmental change can play a big role in the opportunity of a firm to gain economic profits from being the first mover, as these changes can lead to firm proficiency or luck.

Within this paper, the first question that should be addressed is whether the ‘industry’ of higher education is comparable with other markets in which first-mover advantage is examined. Most of the research in FMA is conducted in market economies, in which price signals are created by the forces of supply and demand. If similar characteristics between the higher education sector and regular markets can be found, it is more likely that first-mover advantages can be exploited by universities.

## **2.2 The higher education industry**

The higher education system is not generally regarded as a business, like other industries. In many countries higher education is regarded as a public good and is provided by the government. However, to qualify as a public good in the narrow definition, a good must be both nonrivalrous and nonexcludable (Samuelson, 1954). As most universities force students to pay tuition fees in order to receive education, higher education is excludable. Moreover, an education program may be nonrivalrous at the margin but adding a high number of students in a class would still impact the quality of the program significantly. This makes higher education unambiguously not a public good. Because higher education is excludable and the tuition fee can be regarded as the price of this good, the force of supply and demand is in place. Moreover, the quality of the product, investments and distribution are driven by the price. Even if the price is fixed due to government regulation, which is the case in the Dutch higher education market, the income of universities still depends on the amount of demand for this good. Universities are in the educational business of ‘marketing’ degrees and their reputation to business and the public is important in order to keep their place in the education market (Sung & Yang, 2008).

The Dutch higher education system can be described as a complex hybrid system. Although the universities must give responsibility to the state, most of the decision making is in their own hands (De Boer et al, 2007). The funding of public universities consists of a ‘relatively’ small and fixed contribution of students and is largely funded by the government. The amount of funding is set by the state and consists of a student-based part and a non-student-based part (VSNU, 2020). The student-based funding enables universities to receive more funding if they attract more students, which gives an incentive to ensure the quality of education. As mentioned above, Dutch universities are performance-driven and price mechanisms determine the allocation of resources. However, due to a fixed tuition fee for students, universities are not able to compete on the price of education. This situation differs from a regular market economy in which the price of a good is derived from the law of supply and demand. Because of this, one might ask whether a strategic economic theory like FMA would also be applicable in the higher education market. Do the same advantages and disadvantages for first movers apply to universities that enter a new academic (sub)discipline?

### *2.2.1 Defining a first mover in higher education*

Most universities have been around for centuries and operate in different disciplines. In this paper the emergence of new (sub)disciplines will be adopted as the emergence of new markets. Within these new markets, universities are the suppliers of a new program and students are the consumers. The emergence of computing, for example, is the development of a new discipline that is studied within many universities today. Due to data limitations this thesis will cover early entry in subdisciplines instead of whole new disciplines, as these happened over a longer time period. A subdiscipline could, for example, be a new master program. The analysis of subdisciplines creates a new challenge, what is a subdiscipline? Due to the heterogeneity of study programs, it might be difficult to define an emerging subdiscipline. In order to do so, new programs will be compared on content and focus areas. Further detail on this matter will be provided in the data chapter.

### **2.3 First-mover advantage in higher education**

The existing literature only shows a few examples of research that have a comparative approach. One of the education disciplines where this research is conducted, is the upcoming computing market in 1940-50. Aspray (2000) analyzed the entering of US Universities in academic computing and performed a case study comparing the performance of those universities. This case study could not provide evidence on the advantage of early entry. A few years later, the same kind of research was conducted in France (Mounier-Kuhn, 2012). Also, this case study could not demonstrate the advantage of early entry in a new discipline. Both researchers argue that the result of their case study does not mean that FMA theory is not applicable in the academic workplace. Moreover, a case study of one particular new discipline could not give decisive information over the whole higher education market. This paper will try to demonstrate the presence of FMA within higher education via a different approach, by using a quantitative research method.

#### *2.3.1 Micro aspects of FMA theory*

What drives first-mover advantages? Which firm characteristics drive the opportunity to be a great early mover? The micro side of FMA theory aims to answer this question by looking at the isolating mechanisms and define which drivers are key to an early entry advantage and which are deteriorating this advantage. Lieberman & Montgomery (1988) define a framework of isolating mechanisms which contains the key drivers of pioneer advantage. According to their research, first-mover advantage arises from three key sources: technological leadership, the pre-emption of scarce assets and buyer switching costs. These factors could be exploited by the first firm in an emerging market and can make the first mover more profitable. Other drivers of FMA theory are usually applicable in the context of the conducted research, like the gain of significant sales advantages (Boulding & Christen, 2001) or the advantage of patent protection (Gilbert & Newbery, 1982; Boulding & Christen, 2003). This paper will focus on the drivers that are likely to be applicable in the higher education sector.

The early entry of universities into a new discipline could create the opportunity to improve the program based on what a university has learned from the previous years of organizing the program. This is called the ‘learning’ or ‘experience’ curve where unit production costs tend to fall if the cumulative output is higher (Lieberman & Montgomery, 1988). A university that initiates to enter a new research field has the advantage of reviewing the program and analyze what could be improved in both quality of the program and cost reduction. Moreover, the learning curve could be particularly strong when there is a new program in an innovative research field. If there is no prior experience in this subfield, early movers could benefit from the learning curve and improve their program before other universities enter the market. Although these assumptions don’t find strong empirical support in the literature yet, they are likely to enable first-mover advantages.

Another driver that might be of interest in our research is establishing and maintaining a brand name. Several researchers pointed out that often the leading brand in a market is the one that has been around the longest (Bond & Lean, 1977; Lieberman & Montgomery, 1988). Depending on the market dynamics, consumers lack to learn about alternative brands and favor the one they know, which is the first brand in a market more often (Carpenter & Nakamoto, 1989). Research of higher education in the UK shows that also universities could benefit from ‘successful’ branding, although just a few universities actually reap the benefits of having a good reputation (Chapleo, 2005). Within the Dutch higher education market universities are of relatively the same quality and reputation. However, a university could have a particularly good reputation and education quality in a specific subfield. Universities that enter an emerging (sub)discipline first could establish and maintain a reputation for being the leading university in this research field. Moreover, the information market for choosing a new study program is very large and information asymmetry and quality uncertainty tend to be problematic by choosing the right study (Cooper, 2007). Therefore, factors like reputation or good ratings in league tables have a positive effect on the number of students applying for a certain program (Gibbons et al, 2015). A positive reputation and brand name in a specific subfield are positively correlated with the supportive attitude of students towards the institution, which could lead to both, higher student satisfaction and a higher number of students applying to this program (Sung & Yang, 2008).

Moreover, by entering an emerging (sub)discipline there could be scarcity of professors and researchers because there is a need of new specific knowledge in this research field. The work pressure of staff in the Dutch higher education sector has been very high for decades and partly arises from the scarcity of qualified employees (FNV, 2019). The attraction of the right people at the right moment could lead to a competitive advantage for the early mover. Once a professor is appointed to the emerging research field and is supported with the right budget and people, the university could lock-in this mechanism and obtain early mover advantage.



### *2.3.2 Macro aspects of FMA theory*

Within later research of FMA theory, the macro side of emerging markets got a lot of interest. Lieberman & Montgomery (1988) already stressed the importance of analyzing a broader set of factors that drive FMA, such as environmental change and luck. Although it is widely acknowledged that market dynamics are relevant for enhancing pioneer advantage, research about the macro side of FMA theory is less extensive and conclusive. A small group of researchers managed to extract empirical evidence that supports the importance of environmental dynamics. The research of Suarez & Lanzolla (2007) is one of the most important contributions to the macro side of FMA theory. In their paper the existing literature on FMA is used as a starting point and got exposed to a bigger set of factors. The concept of Lieberman & Montgomery (1988) about isolating mechanisms is adopted and expanded by including the impact of a firm's environment on enabling or disabling FMA. Suarez & Lanzolla (2007) identify two environmental factors that affect FMA; the pace of technology evolution and the pace of market evolution. In this theory, it is presumed that a low pace of technology and market evolution will lead to higher first-mover advantages because there are less disruptive market changes.

The pace of market evolution, which is described by the change in product innovation and customer preferences, affects the presence of first-mover advantages (Suarez & Lanzolla, 2007). Usually, a new market starts with an initial period of slow growth as a product emerges and is followed by a sharp increase in sales, before it reaches a phase of market maturity and decline. Within the higher education market, a new subdiscipline is more likely to emerge from the combination of several existing disciplines. Depending on student preference and the demand from society for particular specialists, a new study program is created. The emerge of a new subdiscipline is likely to follow this pattern in a slow pace. Most study programs that emerge exist for many years and have a stable inflow of new students every year, although some studies get more popular than others over time. With respect to an emerging subdiscipline, it is not very likely that innovation or new insights change the whole market within the first few years, as it usually takes a lot of years for new theories to develop within a discipline. Therefore, the low pace of market evolution benefits early entrants as there is less threat of other universities to take over their market position because there is a low pace of innovation.

### *2.3.3 First-mover disadvantages*

Although the advantages of early entry dominated the literature in the early existence of FMA theory, later research emphasized the potential disadvantages of being first. The main deteriorating drivers of FMA are free-rider effects, technological and market uncertainty and a sluggish response by established incumbents towards shifts in technology or consumer needs (Lieberman & Montgomery, 1988).

Besides above drivers, the existing literature points out many more drivers that could potentially enhance or deteriorate first-mover advantages.

The biggest threat to first movers is usually the free-rider problem (Schnaars, 1986; Lieberman & Montgomery, 1988). Later entrants tend to gain benefit from the pioneer's investments such as buyer education, R&D and reputation without paying for it. Especially in markets with huge research investments and potential information spillover, early followers could benefit from research conducted by the first mover. With respect to universities, a late entrant could benefit from both the research investment of an early mover as well as the way the early mover has organized its education program. Early movers will conduct research in a new subfield and facilitate their education program as good as possible. Because most education programs make use of publicly available research and books, other universities could easily get insights in the way a first mover is organizing their new program. Due to the vast amount of knowledge spillover, it is possible for competitors to free ride on the latest developments of competitors and adopt the information they see fit for their own education program. This effect could disable the advantages of a pioneering university in an emerging discipline.

## 2.4 Hypothesis

Overall, there are several drivers that potentially enhance first-mover advantages. First, the early entry of a university into a new discipline could create the opportunity to improve the program based on previous experience. The learning curve leads to a fall in organizational costs or a higher education quality once the organizers of the program become more experienced. Second, the advantage of being a first mover could result in establishing and maintaining a leading brand name. Universities that enter an emerging (sub)discipline first could establish the reputation of being the leading university in this research field. Information asymmetry and quality uncertainty make it difficult for students to choose the best program which makes the reputation of a university even more important in the decision-making process. The environmental dynamics in the higher education market, such as the low pace of market evolution, make it even more likely that first mover advantages emerge in this sector. The emerge of a new subdiscipline is developing over a longer period of time, consists of a stable inflow of students and does not face disruptive market changes. These potential drivers of FMA suggest that first-mover advantages are also existent in the higher education market. Based on the literature review, the following hypothesis is formulated:

*H1: First movers attract more students than late movers within an emerging (sub)discipline*

All in all, the benefits of first-mover advantage are assumed to be present within the higher education market. The next chapters will demonstrate if the existence of pioneer advantage can be proved by examining the Dutch higher education market.

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## 3. DATA

### 3.1 Measuring first-mover advantage

The Dutch higher education system is organized as a binary model, consisting of 13 universities and over 40 universities for ‘applied sciences’ (the Dutch term is *hogescholen*) (De Boer et al, 2007). Within this thesis, the focus will be on the university sector only and will exclude the universities of applied sciences. The university sector consists of over 300.000 students and has around 55.000 employees (Onderwijs in Cijfers, 2019; VSNU, 2018). Within universities, students can follow a bachelor program and a master program, which are respectively an undergraduate and graduate program under international standards. This paper will analyse first-mover advantage by the number of students registering for a new program.

Because the Dutch higher education systems mainly consist of public universities, there is no profit maximizing goal. Instead, universities aim to deliver the best possible education for the income that they receive from tuition fees and the government (VSNU, 2020). The amount of funding depends on the number of students, which makes it possible for a university to increase revenue by attracting more students and spend it on resources and quality. If a university decides to enter an emerging (sub)discipline by providing a new program, it would need enough students applying for this program in order to earn back the costs. From this point of view, the number of students studying a new program could be a way to measure whether a new program is successful or not. A university that has more registered students than its competitor, would receive more funding which could be used to improve their expertise in this (sub)discipline even more. DUO, an agency of the Dutch Ministry of Education, Culture & Science, collects data on the number of registered students per education program (DUO, 2019). This source is used for the data analysis and contains data for the years 2001-2019.

### 3.2 Sample of first movers

As discussed in the literature review, this thesis will focus on the emergence of disciplines or subdisciplines within higher education. Because the data provided by DUO for Dutch universities is only available from 2001 and onwards, the emergence of a whole discipline is out of scope as these happened over a longer time period. Therefore, this paper will focus on the emergence of subdisciplines like a new specific master program. In order to define such a new subdiscipline, the Dutch register for education (CROHO) is used. This register contains every formal higher education program that is provided in the Netherlands. Each program is linked to an ISAT-code which is depending on the content of the program. For instance, all the Psychology bachelor programs in the Netherlands are provided with the same ISAT-code, which is 56604 (DUO, 2020). In this thesis the ISAT-code will be used to

define a subdiscipline and the education programs attached to this code are in the market. One problem that arises by using this method is that education programs with a minor difference in content don't have the same ISAT-code. Therefore, by defining a submarket, there will be checked for other education programs with a different ISAT-code that should be in the same submarket based on the content and focus area. Moreover, master and bachelor programs, as well as full time and part time programs will be regarded as separate study programs. By following these methods, a sample will be created with multiple submarkets and therefore several first entrants. The order of entry is determined by identifying the first academic year a program is educated, which is registered in the CROHO register.

The sample that is created consists of 40 subdisciplines and 126 universities that entered these submarkets. Appendix A shows the different subdisciplines. Of this sample, 8 subdisciplines include bachelor programs. The remaining 32 subdisciplines consist of master education programs. Table 1 shows the number of entrants as well as the average time in the market. The number of first entrants, which is 40, is in line with the number of emerging subdisciplines. The number of second entrants is higher than the number of emerging subdisciplines due to multiple second entrants in a market. The data sample includes one discipline with a 5<sup>th</sup>, 6<sup>th</sup> and 7<sup>th</sup> entrant. These data points are excluded as they are not representative for the order of entry of these late entrants due to a small sample size of 1.

**Table 1: Descriptive statistics of the data sample**

Order of entry	Number of $n$ th entrants	Years in market
1	40	16,5
2	50	11,0
3	26	9,7
4	7	7,4

N = 123

### 3.3 Control variables

This thesis will make use of control variables, such as the university size and the university quality. With respect to the university size, the number of registered students will be used from the DUO dataset. With respect to the university quality, data of the Academic Ranking of World Universities will be used (ShanghaiRanking Consultancy, 2019). This ranking, called the Shanghai Ranking, contains quality scores of all Dutch universities including a Dutch national ranking. Ranking data is available for 2005-2019. By using this data source, there is still a gap for ranking data between 2001-2005. For these years, the national ranking of 2005 is adopted. This won't change the results significantly as the national

ranking is rather stable over the years. In the methodology sector the use of these control variables will be further justified.

All in all, this data provides a cross-sectional database for examining first-mover advantages in the Dutch higher education market. For every education program in the sample, data is provided on the number of registered students, order of entry, student satisfaction, university size and university quality.

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## 4. METHODOLOGY

In this thesis, market share is modeled as a log linear function of order of entry, time between entries, ranking of the universities and number of students at the universities. The methodology used in this research is adopted from the paper of Urban et al. (1986) in which a cross-sectional dataset is examined.

The dependent variable in this model will be the ratio of the market share for the  $n$ th university to enter a subdiscipline to that of the first university to enter. Since the number of entrants varies per subdiscipline, the absolute share also varies. By using a ratio of the market share, the subdiscipline can be compared on the relative relationship even when the number of entrants is different. If the later entrant has a bigger market share than the pioneer, the ratio is greater than one, if not, the ratio is less than one. The ratio of the market share will be analyzed at different periods after entry, in this way it is possible to look at the short-term effects of early entry as well as the long-term effects. Hence, the dependent variable in this model will be different in the models that are run, because they reflect a different point in time.

The independent variable in this model is the order of entry (first, second, third...). This variable reflects the entry order of a university in a certain discipline. If the hypothesis holds this variable will be negatively correlated to the ratio of market share, which implies that a university that enters the subdiscipline in a later stage will have a relatively lower market share, controlling for all other factors that affect the relative market share. As the time period between the first entrant and the  $n$ th entrant differs per subdiscipline, this variable will be supplemented by another which is the number of years between the  $n$ th entrant and the entrant immediately preceding. Being a later entrant in a subdiscipline could have a different market share effect if the lag between the previous entrant is one year rather than two or three years, for example.

Moreover, two control variables will be included that could modify the actual effect of the order of entry on market share. The first control variable is the university size of the entering university against the university size of the first entrant. This will be measured in the year of entry and is also a ratio for analysis purposes. This variable controls for a potential bias when the university size is correlated with the order of entry. This correlation could, for example, be present when larger universities more often enter a new discipline first and attract more student merely because they are larger and not because they are the pioneer. The second control variable is a ratio of the quality of the entering university measured against the quality of the pioneering university. This variable, just like the university size variable, are both a ratio of the entering university to that of the pioneer. If a later entrant is higher ranked or bigger

than the pioneer, this ratio is greater than one, if not, the ratio is less than one. Also, this variable is measured in the year of entry and is based on the Shanghai Ranking. This variable controls for a possible correlation between the quality of the university and the order of entry. This correlation could, for example, be present when the higher qualified universities enter a new discipline first and attract more students due to their qualification rather than the order of entry.

Including all the variables mentioned above in a regression gives the following equation:

$$M_{ND} = e_{a0} * E_{NDa1} * L_{NDa2} * U_{NDa3} * R_{NDa4} + \epsilon_{ND} \quad (1)$$

$M_{ND}$  = Ratio of the market share of the  $n$ th university to enter subdiscipline  $d$  to the market share of the first university to enter this subdiscipline

$E_{ND}$  = Order of entry of  $n$ th brand in subdiscipline  $d$  ( $n = 1,2,3,4$ )

$L_{ND}$  = Number of years between  $n$  and  $n - 1$  brand entry plus one ( $L_{NC} = 1$  if entry is in the same year)

$U_{ND}$  = Ratio of newly registered students at the university of program  $n$  in the year of entry to the newly registered students of the first university to enter this discipline

$R_{ND}$  = Ratio of the national rank of the university of program  $n$  in the year of entry, according to the Shanghai Ranking, to the nation rank of the first university to enter the discipline.

This model captures the variables that are of interest in this thesis. Based on the literature review and the hypothesis it is possible to forecast the effect of the parameters that are estimated in this model. If  $a_1$  is negative and significant, it supports the assumption that later entry will result in less registered students for an education program. If  $a_2$  is negative and significant it would indicate a lower market share for a university the later it enters the market. If  $a_3$  is positive and significant, a relatively higher university size for the entering university increases the market share for this university. If  $a_4$  is positive and significant, also the relative university ranking of an entering university affects the market share for this university.

Equation (1) will be used in order to calculate the relative market shares of the entrants presented in the results section. For analysis purposes, this equation is transformed using the natural logarithm of the variables, which gives the following equation:

$$M'_{ND} = a_0 + a_1 E'_{ND} + a_2 L'_{ND} + a_3 U'_{ND} + a_4 R'_{ND} + \epsilon_{ND} \quad (2)$$

The primes denote the logs of the variables defined in equation one. A multiple regression is used to estimate the parameters in equation (2).

## 5. RESULTS

In this section the results of this research are discussed. The first section will analyze the results for the first hypotheses, in which the effect of order of entry on number of registrations is assumed. The next section will contain a robustness check analyzing the effect of order of entry on student satisfaction.

### 5.1 Number of registrations and order of entry

The first application of the model is the initial sample of 126 entrants in 40 new subdisciplines. A regression is used to estimate the parameters in equation (2), which are presented in Table 2. The observations in these models are less than the initial sample due to missing data in some of the independent variables.

**Table 2: Multiple linear regression results analyzing the number of registrations**

Model #	(1)	(2)	(3)	(4)	(5)
Dependent Variable	Market Share Year of entry	Market Share After 3 years	Market Share After 5 years	Market Share After 10 years	Market Share After 10 years
<b>Independent Variables</b>					
Order of Entry (E)	-1.00***	-0.54**	-0.50**	-0.17	-0.48***
Lag between Entry (L)	-0.24	-0.03	-0.08	-0.30**	(-)
Students at University (U)	0.86**	0.22	0.16	0.36	0.26
Ranking of University (R)	0.16	0.05	0.10	0.05	-0.01
Constant term	-0.06	0.03	0.05*	0.05**	0.01
Observations	112	109	105	76	76

NOTE: all the variables are logged. Numbers are coefficients. Robust standard errors are used. \*\*\*p<0.01, \*\*p<0.05, \*p<0.1

The results presented in Table 2 show five different models. The dependent variable in these models reflect a different point in time after the entry of a new university. Model 1 shows the regression model where the number of new registrations in the entry year of a university to a new discipline is used as the dependent variable. Model 2, 3 and 4 show the regression models of the ratio of the market share respectively 3, 5 and 10 years after entry. Model 5 excludes the lag between entry variable. As this variable was adopted to support the number of entry effect and is not a control variable, exclusion is justified. The results show that in all models, except Model 4, the order of entry variable is negative and significant. Most of the other independent variables are not significant.



Interpretation of the Order of Entry (E) variable gives that a 1% increase in (E) reduces the ratio of market share variable by x%. In the first model, for example, a 1% increase in (E) reduces the ratio of market share variable by 1%. As the Order of Entry (E) variable denotes the log of entry order (N = 1, 2, 3, 4), the increase in percentage is not easily interpretable. Table 4 will show the results in a different way which makes interpretation of the coefficients easier.

Before the results are further discussed, the use of a linear regression model has to meet several assumptions before interpreting these models. First, multicollinearity among the independent variables is low for all the models. Table 3 shows a correlation matrix as well as the variance inflation factors (VIF) for every independent variable used. Multicollinearity becomes a problem if there is a high correlation between two variables. Overall the strongest correlation is between university ranking and university size. However, the VIF for all variables is relatively low which indicates that multicollinearity is not a big concern in this analysis. Second, the assumption of homoscedasticity should hold, in which the residuals of the regression models should be equal across the regression line. In the regression models above heteroscedasticity is present and therefore robust standard errors are used. One more important aspect in these regression models is that the constant term ( $a_0$ ) should be equal to zero. If a university is the first entrant ( $E = 1$ ), given that the other variables are equal ( $L = 1, U = 1, R = 1$ ), the outcome of equation (1) should be 1 as the ratio of the market share of a first entrant compared to itself should be 1. Because the constant terms in the models in Table 2 are driven towards zero, interpretation of the relative share formulation is possible.

**Table 3: Correlation matrix and variance inflation factor**

	Order of Entry (E)	Lag between Entry (L)	Students at University (U)	Ranking of University (R)	Variance inflation factor*
Order of Entry (E)	1.00				1.72
Lag between Entry (L)	0.64	1.00			1.73
Students at University (U)	0.13	0.19	1.00		2.10
Ranking of University (R)	0.01	-0.08	-0.71	1.00	2.05

NOTE: Variance inflation factors are calculated over Regression Model (1) in Table 2.

As the assumptions that are associated with a linear regression model seem to hold, it is possible to focus on the interpretation of the results. The order of entry variable depicts the decrease in share upon later entry and can be used to estimate the market share of a university entering a new subdiscipline. Table 3 shows the results of relative market share per entrant based on Model 5. This model estimates the ratio of the market share of a new entrant against the first entrant ten years after entry. Moreover, the lag between entry variable is excluded. The values displayed in Table 4 are based on equation (1)

and assume that the number of registrations at a university and the shanghai ranking of the universities are equal ( $U = 1$  and  $R = 1$ ) in order to demonstrate the effect of order of entry only.

**Table 4: Order of Entry penalty based on Regression model 5 in Table 2**

Entry order	Share relative to first university	Shares (%)			
		1st	2nd	3rd	4th
First	1.0	100	--	--	--
Second	0.72	58.1	41.9	--	--
Third	0.59	43.3	31.2	25.5	--
Fourth	0.51	35.5	25.5	20.9	18.1

NOTE: These values are calculated based on equation (1) with  $U = 1$  and  $R = 1$  and the parameters of Regression Model 5 in Table 2

The university that entered the subdiscipline first has a market share drop from 100 percent to 35.5 percent after three other universities entered, ten years after the entry of these universities. This implicates that an early entry premium is evident, given that the number of students at a university and the Shanghai ranking is equivalent. In the case of four universities in a subdiscipline the first entrant has a dominant share position and a 17.1 share point advantage over the fourth entrant. The estimates in Table 3 suggest that the second university entering has less than 75% of new registrations compared to the pioneering university given that the other variables are equal. The third entrant would, in equilibrium, end up with about 60% of new registrations compared to the pioneer and the last entrant about 50% of new registrations. As the number of universities increases, the incremental order of entry effect penalty decreases.

Table 5 shows another market share table but this one is based on Regression Model 1 in Table 2. Despite the fact that the market share division has not reached an equilibrium yet, this table shows that the advantage of an early entrant is even more present in the year of entry of another university. The second university entering only attracts 50% of new students compared to the pioneer. For the third and fourth university this proportion is 33% and 25% respectively. The regression models in Table 2 show that the order of entry effect becomes rather stable three years after entry of a new university, with a coefficient of approximately -0.5. This outcome could substantiate the fact that there is a long-term early mover advantage in the Dutch higher education market.

**Table 5: Order of Entry penalty based on Regression model 1 in Table 2**

Entry order	Share relative to first university	Shares (%)			
		1st	2nd	3rd	4th
First	1.0	100	--	--	--
Second	0.50	66.7	33.3	--	--
Third	0.33	54.5	27.3	18.2	--
Fourth	0.25	48	24	16	12

NOTE: These values are calculated based on equation (1) with  $L = 1$ ,  $U = 1$  and  $R = 1$  and the parameters of Regression Model 1 in Table 2

## 5.2 Robustness

In order to improve the robustness of the results displayed above, the effect of order of entry on student satisfaction is examined. Every year a national student survey is conducted which contains the satisfaction scores of all Dutch higher education programs (Studiekeuze123, 2020). Higher student satisfaction is positively correlated with better education quality (Ali et al, 2016) Moreover, empirical evidence from the UK education market shows that higher student satisfaction is indirectly correlated with more applications, via separately published league tables (Gibbons et al, 2015). This would imply that high rated programs are better qualified programs that could potentially attract more students. Therefore, the demonstration of a higher student satisfaction score for first movers would support the results about the effect of order of entry and number of registrations.

The national student survey is used for the data analysis and contains data for the years 2010-2019. Moreover, the same methodology is adapted that is used for the baseline model, except that the dependent variable is the ratio of student satisfaction of the entering university to the student satisfaction of the first university to enter a subdiscipline.

In Table 6, three regression models are run where the student satisfaction is the dependent variable. Model 1, 2 and 3 show the ratio of student satisfaction respectively in the year of entry, five years after entry and ten years after entry. None of the models finds a significant relationship between the order of entry and the student satisfaction scores. Moreover, several alternative regressions have been run and independent variables have been excluded, but this has not led to a theoretically or empirically improved result. Apparently, the variables used in this model have a poor explanatory power for student satisfaction scores. The fact that data for student satisfaction is only available for the years 2010-2019 and does not concern all study program results for these years could attribute to the lack of explanatory value. The first model that is run only contains 13 observations, which is not a good sample size for the

methodology used. Therefore, the results displayed in Table 6 do not support the robustness of the baseline model.

**Table 6: Multiple linear regression results analyzing student satisfaction**

Model #	(1)	(2)	(3)
Dependent Variable	Student Satisfaction Year of entry	Student Satisfaction After 5 years	Student Satisfaction After 10 years
<b>Independent Variables</b>			
Order of Entry (E)	0.16	-0.02	-0.01
Lag between Entry (L)	0.06	0.0	0.02
Students at University (U)	-0.20*	0.0	-0.03
Ranking of University (R)	-0.12**	0.01	0.0
Constant term	-0.21	0.0	0.0
Observations	13	60	75

NOTE: all the variables are logged. Numbers are coefficients. Robust standard errors are used. \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$

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## 6. DISCUSSION & CONCLUSION

The findings of this paper show strategic implications for universities entering a new subdiscipline. Entering first in an emerging research field results in a market share premium on the long run and could encourage universities to become the pioneer in a specific research field. Later entrants should take into account that they will achieve a lower market share than early entrants and could consider this by developing their entry strategy.

### 6.1 Limitations

The results of this analysis imply a significant market share penalty for later entrants. However, the following reservations should be made. First, these data represent just the last twenty years of the higher education market, which results in an analysis of mainly subdisciplines such as a new master program. Therefore, there should be caution with interpreting these results with respect to whole new disciplines, bachelor programs and part-time study programs. Moreover, the data sample size of a fourth entrant is relatively low ( $N = 7$ ) and the entry of even more universities is not covered in this analysis which might not make the findings in this thesis representative for a discipline with many entrants. Second, the structure of a higher education market is different per country. The Dutch higher education market consists mostly of public funded universities and is bound to a lot of rules with respect to quality and tuition fees. The order of entry effect within higher education could be different in a country where private universities predominate the market. Therefore, the findings of this thesis apply for the Dutch higher education sector and do not have to apply in a different country. Third, it is worth mentioning that the evidence for order of entry effect on number of registrations does not per se implicate that a university is also better off entering an emerging discipline first. A higher market share does lead to more registrations and therefore more revenue from tuition fee, but the expenses are not taken into account in the use of this variable. It could very well be that a pioneering university already made high expenses in the research field of a new discipline due to research and development. Still, there is a premium for entering first by means of a higher market share.

Moreover, the results of this thesis should be interpreted with caution due to potential biases such as correlation of the error term or self-selection bias. It could be very well possible that other variables moderate the actual effect of order of entry, such as the expertise and focus areas of a university in a particular research field which leads to both, an early entry and a higher market share. Moreover, self-selection bias is likely to occur because university decide whether or not they enter a new subdiscipline based on the knowledge they already have.

Another point of discussion is the methodology used in this paper. As the methodology of Urban et al. (1986) is adopted, multiple linear regressions have been run based on a cross-sectional dataset. More recently the use of a panel dataset is standard in similar research papers. This thesis examined the research question using a cross-sectional dataset because this method is effective due to the way the data was provided, as well as the data collection process.

## **6.2 Conclusion**

Main goal of this research was to investigate the existence of first-mover advantage within the Dutch higher education market. Based on the existing literature on first-mover advantage and the characteristics of the higher education market, first mover-advantage was assumed to be present in this market. In particular, the presence of a learning curve, establishing and maintaining a leading brand name and quality uncertainty within this market are drivers that could enhance early entry advantage.

Empirical analysis on the sample data of the higher education market has led to a significant effect of the order of entry with respect to the number of new registered students for an emerging education program. A university entering a new subdiscipline first attracts more registered students to its program compared to university that enter subsequently. Three years after the entry of a new university, the first mover advantage reaches a stable level which is still present ten years after entry. These results substantiate a long-term effect of first-mover advantage in the Dutch higher education market on the number of registering students. The central hypothesis ( $H_1$ ) is therefore not rejected.

All in all, based on the analysis carried out in this thesis the main research question can be addressed. Although the relation between order of entry and student satisfaction has not been found, the significant relationship between order of entry and number of students shows that there is, indeed, a long-term market share advantage for pioneering universities. Therefore, pioneering universities in an emerging (sub)discipline do gain first-mover advantages compared to later entrants, keeping the limitations of this research in mind.

## **6.3 Recommendations**

This analysis of order of entry effects in the higher education program indicates the presence of an important market theory. The results of this thesis are consistent with other empirical evidence on first-mover advantages like the studies of Bond and Lean (1977) and Whitten (1979). However, there has not yet been a study analyzing first-mover advantage in the higher education market using a quantitative method, like this thesis. Therefore, further research could be of high relevance for the higher education market and the innovation strategy of universities.

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One direction of further research is to extend this study over a longer time period in order to examine the emergence of disciplines instead of subdisciplines in the Dutch higher education market. A larger data sample could provide this foundation and might be retrievable in cooperation with the governmental instances responsible for education. Another recommendation would be to reconsider the control variables used in this research question. The control variables that were used have been justified, but they did not have a significant effect on the ratio of market share. A different way of using the control variables or even using different variables could give more confidence in analyzing the actual effect of first-mover advantages in the higher education market. An extra variable that, for example, could be added should focus on the attractivity and quality of a university in a certain subfield. Although Dutch universities have rather the same quality, there are difference in expertise and this could affect the decision of a university to enter an emerging (sub)discipline, as well as the number of registered students in their program.

Another direction of further research could focus on the actual drivers behind the advantage for early movers in the higher education market. Although the literature review already argues that there are several drivers supporting first-mover advantages, further research could provide a more solid foundation for this.

First-mover advantage is an interesting and actual research topic within strategy economics and could be of importance to universities in optimizing their innovation strategy. This analysis of the effect of order of entry on market share ratio in the higher education market shows the potential existence of pioneer advantage for universities and is a first step toward identifying and understanding the first-mover advantage effect within the higher education market.

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## 9. APPENDIX

### Appendix A: emerged subdisciplines in the Dutch higher education market

ISAT-code	Education program	ISAT-code	Education program
50007	B Bestuurs- en Organiseringswetenschap	60224	M International and European Law
50017	B European Law School	60255	M Information Sciences
50035	B Culturele Antropologie en Ontwikkelingssociologie	60260	M Psychologie
50393	B Liberal Arts and Sciences	60353	M Electrical Engineering
50952	B International Business Administration	60359	M Systems and Control
56098	B Midden-Oostenstudies	60364	M Computing Science
56553	B Gezondheidswetenschappen	60383	M Psychology (research)
56631	B Algemene Sociale Wetenschappen	60408	M Ondernemingsrecht
60029	M Industrial Engineering and Management	60436	M Applied Physics
60039	M Oudheidstudies (research)	60437	M Chemical Engineering
60046	M Finance	60439	M Mechanical Engineering
60063	M Marketing Management	60645	M Human Resource Management
60066	M Strategic Management	60734	M Internationale betrekkingen
60072	M International Business Law	60808	M Erfgoedstudies
60084	M Rechtsgeleerdheid	66157	M Farmacie
60120	M Health Sciences (research)	66226	M Biomedical Engineering
60133	M Archeologie (research)	66286	M Life Science and Technology
60139	M Geschiedenis (research)	66551	M Geneeskunde
60200	M Astronomy	66851	M Health Sciences
60222	M Arbeidsrecht	69303	M European Studies